The Springfield Centre 2022 - 2023 Planning Subject: Science

CYCLE 1

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	Baseline assessment	Animal and Plant Cells	Prokaryotic vs Eukaryotic cells	Cell specialisation and Differentiation	Light vs Electron Microscope and counting microorganisms	Culturing Microorganisms	Cell Division	Stem Cells	Diffusion
Learning intentions (With links to the NC and spec)	Baseline assessment: Feedback given and targets set	Label diagrams of animal and plant cells. Describe the function of the main organelles.Prepare slides of plant and animal cells and describe the procedure. Correctly use a microscope to observe cells under different magnifications.	Identify plant, animal and bacterial cells and classify them as eukaryotic or prokaryotic cells. Label diagrams of bacterial cells. Describe the differences between eukaryotic and prokaryotic cells in terms of structure and size. Describe the differences in magnification and resolution of light and electron microscopes. Explain how electron microscopy has increased understanding of organelles.	Explain the need for differentiation in a multicellular organism. Describe the differences between differentiation in plants and in animals. Explain how specialised cells are adapted for their function.	Describe the differences in magnification and resolution of light and electron microscopes. Explain how electron microscopy has increased understanding of organelles.Students should be able to calculate cross-sectional areas of colonies or clear areas around colonies using πr².Students should be able to calculate the number of bacteria in a population after a certain time if given the mean division time.	Know that bacteria multiply by simple cell division. Know how bacteria can be grown. Know procedure to prepare an uncontaminated culture. Explain why cultures are incubated at a maximum temperature of 25°C. Describe why uncontaminated cultures are necessary in research.	Describe what a chromosome is and where chromosomes are found in the cell Draw and label diagrams showing cell, nucleus, chromosome and gene. Consider the scale of these structures. Arrange chromosome images into pairs. Describe simply how and why body cells divide by.	A stem cell is an undifferentiated cell of an organism which is capable of giving rise to many more cells of the same type, and from which certain other cells can arise from differentiation. Students should be able to describe the function of stem cells in embryos, in adult animals and in the meristems in plants. Stem cells from human embryos can be cloned and made to differentiate into most different types of human cells. Stem cells from adult bone marrow can form many types of cells including blood cells. Meristem tissue in plants can differentiate into any type of plant cell, throughout the life of the plant. Knowledge and understanding of stem cell techniques are not required. Treatment with stem cells may be able to help conditions such as diabetes and paralysis.	Explain how temperature, concentration gradient and surface area affect the rate of diffusion. Give examples of substances that diffuse into and out of cells. area: volume ratios. Explain how the small intestine and lungs in mammals, and roots and leaves in plants, are adapted for exchange of substances. Describe and explain how an exchange surface is made more effective.
Cultural Capital/ British Values			An opportunity to discuss the history of infectious disease.					Discuss the possibility of how, in the future, we could treat previously untreatable diseases by using stem cell technology.	
Key words		Cell Membrane, Mitochondria, Nucleus, Cell Wall, Cytoplasm, Ribosomes, chlorophyll, organelle	Nucleus, Cell Wall, Prokaryote, Eukaryote	Sperm Cell, Egg Cell, nerve cell, palisade cell	Coarse Knob, Fine Knob, Magnification, Plant cell, Animal cell	Agar, cross contamination, antiseptic techniques, incubation	Mitosis, chromosomes	undifferentiated, stem cells, meristem, cloning	Diffusion, concentration gradient, cell membrane
Science Careers		Microbiology				Food Technologist, Agricultural Inspector,			

CYCLE 2

	1	2	3	4	5	6	7	8	9
Unit of work / topic	Required Practical Food Tests	Enzyme basics	Enzymes in digestion and Enzyme practical	Circulatory system, blood components and Lung Structure	The Heart and Heart Dissection	Health Issues and Non Communicable Disease	Plant Tissues and Organs	Communicable Disease (Pathogens)	Diseases
Learning intentions (With links to the NC and spec)	Required practical activity 4: use qualitative reagents to test for a range of carbohydrates, lipids and proteins. To include: Benedict's test for sugars; iodine test for starch; and Biuret reagent for protein. AT skills covered by this practical activity: AT 2 and 8. This practical activity also provides opportunities to develop WS and MS.	Describe the functions of the digestive system to digest and absorb foods. Identify the positions of the main organs on a diagram of the digestive system. Know that food molecules must be small and soluble in order to be absorbed into the blood. Describe the functions of the organs in the system. Explain how the small intestine is adapted for its function. Define the terms 'catalyst' and 'enzyme'. Describe the properties of enzymes. Explain why enzymes are specific and are denatured by high temperatures and extremes of pH. Use the lock and key theory and collision theory to explain enzyme action.	Carry out a safe, controlled investigation to measure the rate of the catalase under different conditions. Draw a diagram of the apparatus and write a method. Identify variables. Present and analyse the results: calculate rates of reaction using raw data and graphs. Draw conclusions and give explanations for the results. Explain why foods need to be digested into small, soluble molecules. Describe the three types of enzymes involved in digestion, including the names of the substrates, products and where the enzymes are produced. Explain how bile helps in the digestion of fats. Interpret graphs to determine the optimum temperature or pH for an enzyme.	Explain how the blood vessels are adapted for their function. Describe problems associated with the heart and explain how they can be treated. Evaluate the use of drugs, mechanical devices and transplants to treat heart problems, including religious and ethical issues. Describe the four main components of blood. Explain how each component is adapted for its function. Identify pictures of the different blood cells	Describe the functions of the heart and circulatory system. Describe and label a diagram of the heart showing four chambers, vena cava, pulmonary artery, pulmonary vein and aorta. Describe the flow of blood from the body, through the heart and lungs and back to the body. Explain how the heart is adapted for its function. Describe the heart as a double pump and explain why this is efficient. Describe the function of the pacemaker cells and coronary arteries. Label the main structures in the gas exchange system – trachea, bronchi, alveoli and capillary network around alveoli. Explain how the alveoli are adapted for efficient gas exchange.	Explain how diet, stress and life situations can affect physical and mental health. Give examples of communicable and non-communicable diseases. Describe examples of how diseases may interact. Describe the effects of diet, smoking, alcohol and exercise on health. Explain how and why the Government encourages people to lead a healthy lifestyle. Give risk factors associated with cardiovascular disease, Type 2 diabetes, lung diseases and cancers. Describe some causes of cancer, eg viruses, smoking, alcohol, carcinogens and ionising radiation. Describe the difference between benign and malignant tumours. Explain how cancer may spread from one site in the body to form a secondary tumour in another part of the body.	Identify the tissues in a leaf and describe their functions. Relate the structure of each tissue to its function in photosynthesis. Explain why there are more stomata on the lower surface of a leaf. Describe the role of stomata and guard cells to control water loss and gas exchange. Calculate stomatal density. Describe the organs that make up the plant transport system. Describe the role of xylem, phloem and root hair cells and explain how they are adapted for their functions. Define the terms 'transpiration' and 'translocation'.	Define the term pathogen and state the four main groups of pathogen. Explain how pathogens can be spread to plants or animals and cause infection. Describe the main differences between bacteria and viruses. Explain how the spread of disease can be reduced or prevented.	Explain how diet, stress and life situations can affect physical and mental health. Give examples of communicable and non-communicable diseases. Describe examples of how diseases may interact. Describe the effects of diet, smoking, alcohol and exercise on health. Explain how and why the Government encourages people to lead a healthy lifestyle. Give risk factors associated with cardiovascular disease, Type 2 diabetes, lung diseases and cancers.
Cultural Capital/ British Values						Suggest reasons why the perception of risk is often very different from the measured risk (eg voluntary vs imposed risks, familiar vs unfamiliar risks, visible vs invisible hazards).			Support students to make healthy lifestye choices which will prolong and enhance life quality.
Key words		lock and key, substrate, active site, substrate enzyme complex, catalyst, temperature, pH, carbohydrase, protease, lipase		white blood cells, platelets, red blood cells, plasma	vavles, ventricle, atrium, aorta, vena cava, pulmonary artery/vein	Cancer, diabetes, heart disease, carcinogens, radiation, benign and malignant tumours	xylem, palisade cells, epidermis, phleom, spongy mesophyll, waxy cuticle, guard cells, stomata, transpiration, translocation	Pathogen, infection, bacteria, viruses	communicable, non communicable, risk factor
Science Careers	Food technologist			Fitness industry, physiotherapist.	Dietitian, Nurse, Exercise Physiologist, Doctor	Nurse, Doctor, Health and Safety advisor, first aider, Paramedic			

CYCLE 3

	1	2	3	4	5	6	7	8	9
Unit of work / topic	Disinfectants and bacterial growth	Plant Disease and Defences	Photosynthesis	Respiration	Response to Exercise and Metabolism	Assessment			
Learning intentions (With links to the NC and spec)	Plan and carry out a safe investigation into the effect of disinfectants or antibiotics on bacterial growth. Calculate the cross-sectional areas of clear zones around disinfectant/ antibiotic discs using πr2 . Present and analyse the results. Give examples of painkillers and other medicines used to treat symptoms. Interpret data about painkillers and other medicines. Describe Fleming's discovery and explain its importance.	Describe the symptoms and effects of Tobacco mosaic virus and its effects. Describe the symptoms and effects of Rose black spot fungal infection Explain how aphids affect plant growth. Carry out a controlled investigation into the effects of nitrate and magnesium ion deficiencies and link to active transport (4.1.3.3 and see alternative investigations in 4.2.3.2). Describe the physical and chemical ways plants can resist microorganisms. Describe mechanical adaptations to deter animals.	Write the word and symbol equation for photosynthesis. Explain why photosynthesis is important for the survival of other organisms. Investigate the need for light, carbon dioxide and chlorophyll to make glucose. Explain why plants should be de-starched before photosynthesis experiments and describe how this is done. Describe experiments to show that plants produce oxygen in the light. Test to see if a leaf contains starch. Explain why the leaves are tested for starch and not for sugar. Describe the test for oxygen. Interpret results and relate to photosynthesis equation. State factors that can limit the rate of photosynthesis. Interpret data showing how factors affect the rate of photosynthesis. Required practical: plan a method. Required practical: carry out an investigation, collect, present and analyse the results. Calculate the rate using numerical information or graphs.	State that all animals and plants produce carbon dioxide and water all the time as a by-product of aerobic respiration. Write the word equation for aerobic respiration. Define the term 'aerobic'. Describe what organisms need energy for. Describe tests for carbon dioxide and water. State the site of aerobic respiration and be able to give examples of cells that contain a lot of mitochondria (links with 4.1.1.2). Define the term 'anaerobic'. Explain why anaerobic respiration is less efficient than aerobic respiration. Write the word equation for anaerobic respiration in animal cells. Write the word and symbol equation for anaerobic respiration in yeast cells. State that anaerobic respiration in yeast is called fermentation. Explain why yeast is used to make bread and alcoholic drinks. Interpret data from yeast investigation.	Describe and explain the changes that occur in the body during exercise. Design and carry out an investigation about the effects of exercise on the body. Present and interpret data about heart rate, breathing rate and breath volume. Interpret data relating to the effects of exercise on the body, eg spirometer tracings. Describe the effects of long periods of vigorous exercise on the body. Define the term 'oxygen debt'. Explain what happens to lactic acid once exercise stops.	Assessment is integrated into learning during each lesson. Preparation for exams is conducted through exams questions during lessons and further exam questions are used; along with a variety of other methods, to inform data drop and student progress tracking.			
Cultural Capital/ British Values		Describe and evaluate, with the help of data, methods that can be used to tackle problems caused by human impacts on the environment.							
Key words		Physical, chemical, mechanical	Photosynthesis, endothermic, glucose, carbon dioxide, oxygen	Respiration, glucose, red blood cells, lungs, diffusion, carbon dioxide	pulse, heart rate, oxygen debt, lactate, glucose, aerobic, anaerobic				
Careers in Science				Brewer (Yeast, anarobic respiration)	Personal Trainer				

10	11	12	13
Osmosis and Required Practical	Active transport	Organisation in the human body	Assessment
Define the term 'osmosis'. Observe and explain the effects of water and concentrated salt solution on cells of onion/ beetroot/ rhubarb. Use a model to show osmosis Make predictions with explanations.	Define the term 'active transport'. Describe where active transport occurs in humans and plants and what is transported. Explain why active transport requires energy. Explain how active transport enables cells to absorb ions from very dilute solutions. Explain the relationship between active transport and oxygen supply and numbers of mitochondria in cells.	Organ, organ system and organism, and be able to give examples of each. Have an understanding of the size and scale of cells, tissues, organs, organ systems and organisms. Describe the main systems in the human body and their functions.	Students to complete assessment on content covered. Time has been made available for reflection.
Osmosis, concentration, semi permiable membrane	Active transport, concentration gradient, glucose, minerals	Cell, tissue, organ, organ system, organism	

10	11	12	13
Human Defence Systems	Treating Diseases	Drug development Painkillers and Antibiotics	Assessment
Describe the body's first line defences. Explain how microbes make us feel ill and how viruses damage cells. Explain how the immune system defends against disease. Describe what white blood cells do. Explain why antibodies are specific for one pathogen/ antigen. Describe what a vaccine contains. Explain how vaccines prevent disease. Explain the idea of 'herd immunity'. Explain how antibiotics treat only bacterial diseases and how this has saved lives. Describe the problems associated with antibiotic resistance. See 4.6.3.7 Explain the difficulty in developing drugs that kill viruses without damaging body tissues.	Describe the symptoms, mode of transmission, prevention and treatment for measles, HIV and AIDS, salmonella and gonorrhoea. Describe colds and flu as viral diseases. Describe athlete's foot as a fungal disease. Describe the life cycle of the malarial protist. Describe the symptoms, mode of transmission, prevention and for malaria.	State which drugs come from plants and microorganisms. Explain why drugs need to be tested before they can be prescribed. Describe the main steps in the development and testing of a new drug. Give reasons for the different stages in drug testing. Explain the terms placebo and double-blind trial.	Students to complete assessment on content covered. Time has been made available for reflection.
		Explain that the process of peer review helps to detect false claims and to establish a consensus about which claims should be regarded as valid.	
White blood cells, antibodies, specific, pathogen, herd immunity, vaccine, non specific defence, specific defence			

10	11	12	13